Utilization of RAP

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CONFERENCE
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History

Many recycled products have been utilized in HMA

- Glass
- Used Tires
- Roofing Shingles
- Industrial Byproducts
What is RAP?

**Reclaimed Asphalt Pavement**

Old asphalt pavement that has been removed from the roadway by either full-depth removal or milling.
RAP Stockpile
RAP Stockpile
Our transportation system is costly... But it also represents an investment turned into a savings account...
Where does it go?

- Landfill
- Embankments
- Roadbeds
  - Base and Subbase
  - Shoulder Widening
- New pavement
  - Highest and Best Use
Roadbeds

Value is roughly equal to granular base
Roadbeds

Value is roughly equal to granular base Replacement Value Plus...

$ Reduced Haul if processed in place
$ Conservation of aggregate resources
$ Overall economics (Fuel Consumption & Equip. Savings)

This historically accounted for the largest recycling tonnage
Shoulders

Value is greater than granular material + increased structural number

$ Reduced Haul when processed and left in place
$ Conservation of aggregate resources
$ Overall economic benefit and less shoulder maintenance
$ Energy savings vs. paved shoulders
$ Safety of wider shoulder
Milling pavement
Millings added to Shoulder
Finished RAP Shoulder
RAP Shoulders
RAP Shoulders
RAP Shoulders
RAP in Recycled New Pavement

Value = Virgin Aggregate + Asphalt cost

20% RAP on a 50,000 ton DOT Project

10,000 tons of RAP @ 6.0% Asphalt

- 9400 ton Aggregate @ $20 = $188,000
- 600 tons of Binder @ $550 = $330,000

TOTAL $518,000

or $10.36/project ton
Illinois Tollway Authority (Since 2005)

- RAP Usage: 1.8 million tons (enough to fill Soldier Field Stadium from top to bottom)
- Asphalt Cement: Saved nearly 4 million barrels of liquid asphalt
- Scrap Tires: Utilized more than 228 thousand for better durability, lower noise levels, and better friction values
- Saved $10 million, about $1/ton per 1% RAP usage...15% RAP = $15 ton savings
RAP in New Pavement: Case Study

SDDOT

- Since expanded use in 2006, RAP: 600k tons
- Asphalt Cement: Saved nearly 36,000 tons of binder
- Saves roughly $3.5 million/year in Program Cost
- Expecting additional value with WMA
Issues to Address

- Project Planning
  - Looking at less dollars available!
  - Larger backlog!
  - RAP is quality aggregate
  - Quantities/ Binder selection?
  - Sequence of Work...Mill to Mix
  - Plan Information (Original Mix Attributes, Original Aggregate Attributes, Original Pavement Thickness)
Contractor’s

Knowledge = Quality = Profitability

- Experience utilizing RAP
- RAP creates new volumetric issues (VMA and Va areas)
- Virgin aggregate gradation for RAP
- QC/ QA properties
Mix Issues to Address

- **Long Term Durability**
  - Binder properties in Superpave testing system using RAP aggregate
  - Use of polymer modified asphalts with RAP
  - Use of softer virgin binder grades with RAP

- ARE the correct Specifications in place?
National Research

- Numerous Tests at NCAT Test Track & Other Accelerated Testing Sites
- NCHRP 9-12: Incorporation of Reclaimed Asphalt Pavement in the Superpave System
  - Black rock argument
  - Binder grade selection
  - Mixture and pavement performance
NCHRP 9-12 Conclusions

- RAP is not just a Black Rock.
- Significant binder blending occurs.
- Significant binder savings will occur.
- Mixtures will perform if sufficient preliminary engineering is conducted.
RAP + Virgin HMA

- Equivalent Aggregate Characteristics
- Proper Binder Grade
- Quality Control
- Construction Specifications
RAP Management

Knowledge of the RAP Quality is essential!

- Binder Quantity
- Binder Grade
- Gradation
- CAA
- FAA
- F&E
- SE
The Big Question

How Much RAP Can Be Utilized?

- Specifications
- Existing RAP Properties
- %’s up to 50% are common
- %’s over 50% are being experimented with
High levels of #200 material

- Milling RAP generates #200 material
- Fractionating / Crushing generates #200
- #200 may often limit the amount of RAP that may be added to Specification HMA
- Consider mixes or virgin aggregate combinations that can accommodate the high #200
Steps to minimize excess 

- If possible, screen RAP before crushing
  - Less material to crush
  - Creates less dust
- Adjust milling operations
  - Travel speed
  - Milling head speed
  - Depth
So how much RAP can I add?

- Depends on the Specifications
- Higher %’s require increased QC
- Preliminary testing and design considerations are necessary
- Pick and choose where to use your RAP

Knowledge = Quality = Profitability
Field Issues

- Field control of volumetrics
- Consistent RAP
  - Quantity
  - Quality
- Air voids (RAP binder content)
- Field VMA specification
- Inplace density
**The Bottom Line**

**Reclaimed Asphalt Pavement:**

- Saves dwindling aggregate resources
- Recovers non-renewable petrochemical resources
- Diverts large volumes of materials from overloaded landfills
- Reduces road building costs
- Available close to the market
  - reduces trucking